

What is claimed is:

1. A semiconductor chip applicable to a terahertz electromagnetic-wave device for generating and detecting terahertz electromagnetic waves, said semiconductor chip comprising:

a single crystal semiconductor substrate; and

a Group III-V compound semiconductor layer provided on said single crystal semiconductor substrate, said Group III-V compound semiconductor layer having a first main surface facing said single crystal semiconductor substrate and a second main surface opposed to the first main surface,

wherein, in the second main surface side of said Group III-V compound semiconductor layer, the concentration of Group V atoms is higher than the concentration of Group III atoms, and said Group III-V compound semiconductor layer includes oxygen.

2. A semiconductor chip applicable to a terahertz electromagnetic-wave device for generating and detecting terahertz electromagnetic waves, said semiconductor chip comprising:

a single crystal semiconductor substrate; and

a Group III-V compound semiconductor layer provided on said single crystal semiconductor substrate, said Group III-V compound semiconductor layer having a first main surface facing said single crystal

semiconductor substrate and a second main surface opposed to the first main surface,

wherein, in the vicinity of the surface of said Group III-V compound semiconductor layer, the concentration of Group V atoms is higher than the concentration of Group III atoms, and the ratio of the concentration of the Group V atoms with respect to the concentration of the Group III atoms increases from the first main surface toward the second main surface of said Group III-V compound semiconductor layer.

3. A terahertz electromagnetic-wave device for generating and detecting terahertz electromagnetic waves, said terahertz electromagnetic-wave device comprising:

a single crystal semiconductor substrate;
a Group III-V compound semiconductor layer provided on said single crystal semiconductor substrate, said Group III-V compound semiconductor layer having a first main surface facing said single crystal semiconductor substrate and a second main surface opposed to the first main surface, and

a pair of antenna electrodes provided on the second main surface of said Group III-V compound semiconductor layer and separated from each other by a minute gap,

wherein, in the second main surface side of said

Group III-V compound semiconductor layer, the concentration of Group V atoms is higher than the concentration of Group III atoms, and said Group III-V compound semiconductor layer includes oxygen.

5 4. A terahertz electromagnetic-wave device for generating and detecting terahertz electromagnetic waves, said terahertz electromagnetic-wave device comprising:

 a single crystal semiconductor substrate;

10 a Group III-V compound semiconductor layer provided on said single crystal semiconductor substrate, said Group III-V compound semiconductor layer having a first main surface facing said single crystal semiconductor substrate and a second main surface
15 opposed to the first main surface, and

 a pair of antenna electrodes provided on the second main surface of said Group III-V compound semiconductor layer and separated from each other by a minute gap,

20 wherein, in the second main surface side of said Group III-V compound semiconductor layer, the concentration of Group V atoms is higher than the concentration of Group III atoms, and the ratio of the concentration of the Group V atoms with respect to the
25 concentration of the Group III atoms increases from the first main surface toward the second main surface of

said Group III-V compound semiconductor layer.

5 5. A method of manufacturing a semiconductor chip, which is applicable to terahertz electromagnetic-wave devices for generating and detecting terahertz electromagnetic waves, said method comprising the steps of:

 preparing a single crystal semiconductor substrate; and

10 epitaxial-growing a Group III-V compound semiconductor layer, which has a first main surface facing said single crystal semiconductor substrate and a second main surface opposed to the first main surface, directly or indirectly on said single crystal semiconductor substrate, while increasing the supply
15 amount of Group V material and lowering the temperature of said single crystal semiconductor substrate,

 whereby, in the second main surface side of said Group III-V compound semiconductor layer, the concentration of Group V atoms is higher than the
20 concentration of Group III atoms, and said Group III-V compound semiconductor layer includes oxygen.

 6. A method of manufacturing a semiconductor chip, which is applicable to terahertz electromagnetic-wave devices for generating and detecting terahertz
25 electromagnetic waves, said method comprising the steps of:

preparing a single crystal semiconductor substrate; and,

epitaxial-growing a Group III-V compound semiconductor layer, which has a first main surface facing said single crystal semiconductor substrate and a second main surface opposed to the first main surface, directly or indirectly on said single crystal semiconductor substrate, while increasing the supply amount of a Group V material and lowering the temperature of said single crystal semiconductor substrate,

whereby, in the second main surface side of said Group III-V compound semiconductor layer, the concentration of Group V atoms is higher than the concentration of Group III atoms, and the ratio of the concentration of the Group V atoms with respect to the concentration of the Group III atoms increases from the first main surface toward the second main surface of said Group III-V compound semiconductor layer.

7. A method of manufacturing a terahertz electromagnetic-wave device for generating and detecting terahertz electromagnetic waves, said method comprising the steps of:

preparing a single crystal semiconductor substrate; and

epitaxial-growing a Group III-V compound

semiconductor layer, which has a first main surface facing said single crystal semiconductor substrate and a second main surface opposed to the first main surface, directly or indirectly on said single crystal semiconductor substrate, while increasing the supply amount of a Group V material and lowering the temperature of said single crystal semiconductor substrate, whereby, in the second main surface side of said Group III-V compound semiconductor layer, the concentration of Group V atoms is higher than the concentration of the Group III atoms, and said Group III-V compound semiconductor layer includes oxygen; and forming a pair of antenna electrodes separated from each other by a minute gap on the second main surface of said Group III-V compound semiconductor layer.

8. A method of manufacturing a terahertz electromagnetic-wave device for generating and detecting terahertz electromagnetic waves, said method comprising the steps of:

preparing a single crystal semiconductor substrate; and

epitaxial-growing a Group III-V compound semiconductor layer, which has a first main surface facing said single crystal semiconductor substrate and a second main surface opposed to the first main surface,

directly or indirectly on said single crystal semiconductor substrate, while increasing the supply amount of a Group V material and lowering the temperature of said single crystal semiconductor substrate, whereby, in the second main surface side of said Group III-V compound semiconductor layer, the concentration of Group V atoms is higher than the concentration of Group III atoms, and the ratio of the concentration of the Group V atoms with respect to the concentration of the Group III atoms increases from the first main surface toward the second main surface of said Group III-V compound semiconductor layer; and

forming a pair of antenna electrodes separated from each other by a minute gap on the second main surface of said Group III-V compound semiconductor layer.